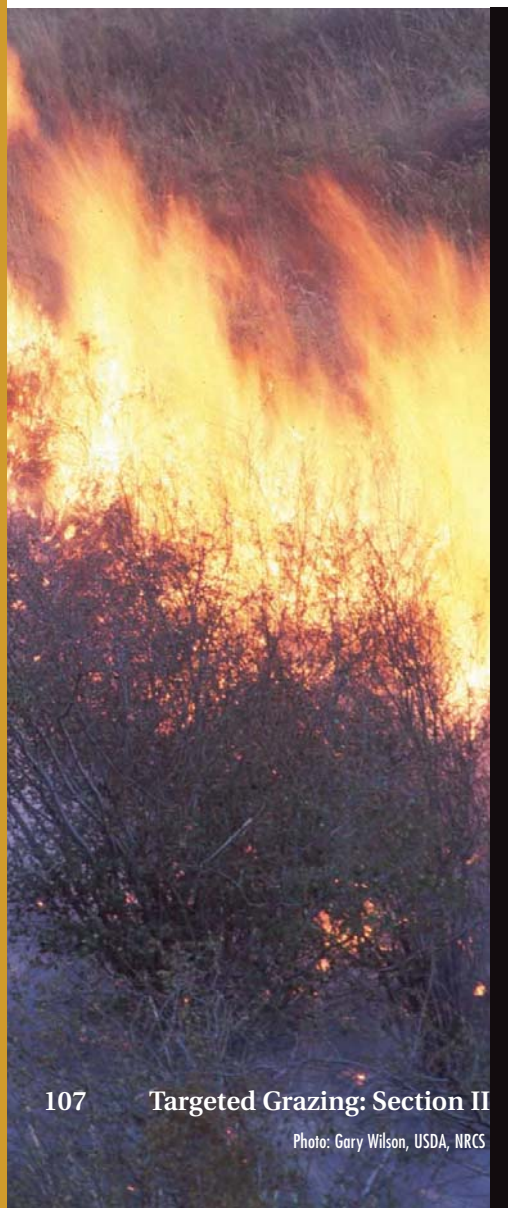
CHAPTER 12:
Targeted Grazing to Manage Fire Risk

By Charles A. Taylor, Jr.

Charles A. Taylor, Jr. is Professor and Superintendent of the Texas A&M Agricultural Research Station near Sonora, TX.



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10 KEY POINTS

- Natural and human-caused wildfires have long shaped North American landscapes.
- A national focus on reducing fire fuels is opening a door for targeted grazing.
- Targeted grazing typically tackles four fire fuel types – grass, shrub, slash, and timber.
- Knowledge of fuel characteristics and species foraging habits lays the groundwork for developing grazing prescriptions.
- Ecological objectives should be an integral part of any fuel-reducing strategy.
- Managing vegetation that contributes to wildfires is a long-term process that requires patience.
- Timing of grazing is critical both for animal health and fuel-load reduction.
- Supplements can help animals remain healthy and fight plant toxins.
- Prescribed burning and targeted grazing can work hand in hand to reduce fire fuel loads.
- An inventory that assesses current plant status will determine the kind and combination of treatments required.

INTRODUCTION

Fire has long shaped North American landscapes. Ignited by lightning and Native Americans, fires burned across vast areas, stopped only by rainfall and natural barriers. Fires burned frequently on dense prairies and shrublands where fuels accumulated rapidly. Steep, rocky, less densely vegetated sites burned less, serving as firebreaks until the right mix of weather and fuel loads provided optimum conditions for fire. Variations in plant communities, combined with variable weather and topography, created landscapes where fire burned in patches or mosaics, resulting in a variety of fuels, fire intensities, and habitats for livestock and wildlife.

Accidental and lightning-caused fires still burn across the natural landscapes, but the land has evolved to include a complex of cities, housing developments, cultivated lands, utility lines, fences, roads, and highways. The 2000 fire season was one of the worst in 50 years, with nearly 123,000 fires burning 8.4 million acres. More than $2 billion in federal dollars and countless dollars from state and local funds were spent to suppress these wildland fires.[7] The average acreage burned nationally has remained high with 2006 surpassing the devastation of 2000, and fire risk continues to mount. Much of this increased fire risk has resulted from community growth in the wildland-urban interface, build-up of forest and woodland fuel loads from years of fire suppression, and fire-prone ecosystems created by the invasion of exotic plants like cheatgrass.[7]

National efforts are beginning to focus on preventing fuel build-up,[5] but public opinion and firefighting activity have continued to foster fire suppression, resulting in the accumulating fuel loads. Meanwhile, the number of livestock grazing Western rangelands has declined dramatically in recent years, allowing grasses and other fine fuels to further accumulate. Sooner or later, fires will break out in these high-fuel areas, likely with devastating consequences.

Vegetation Management Opportunities

The higher the intensity of fire, the greater its impacts on timber, forage, property, and humans. Humans have little or no control over many factors that increase fire severity, but the intensity can be reduced by manipulating the kind and amount of vegetation (Figure 1). Carefully managed grazing is one important tool that can alter the amount and continuity of vegetation to reduce the potential for devastating wildfire (i.e., Fuel Load and Type and Live/Dead Fuel Mix in Figure 1).

Traditionally, mechanical and chemical treatments have been used to manage woody and herbaceous plants that create fuel loads. Mechanical approaches – mowing, chopping, and chaining of unwanted vegetation – can be effective, but the heavy equipment required works only on relatively gentle terrain, disturbs soil and contributes to erosion, and costs hundreds of dollars per acre. Likewise, herbicides can be effective, but concern is growing over their environmental and health risks. Herbicide applications are also expensive, and some have questioned their value in reducing fire risks.

Prescribed burning is gaining favor as a way to reduce fire risk, but it comes with concern of fire escaping and the associated liability. Executing a prescribed fire safely and effectively requires well trained personnel, often in short supply. In light of the cost and potential drawbacks of traditional vegetation management options, grazing offers several benefits. Livestock disturb soil less than mechanical techniques, have a low risk of environmental contamination compared with herbicides, and avoid impairing air quality as with prescribed burning. What's more, targeted grazing is generally the least expensive.

Fuel types and characteristics must be kept in mind when developing prescriptions to manipulate fuel loads with grazing. Fire fuels are classified into four groups – grasses, shrub, slash, and timber. Finer fuels are at greater risk for ignition but tend to burn quickly and produce fires of lower severity. Some plants, like juniper and sagebrush, contain plant compounds that are volatile and easily ignited. They are said to virtually explode when ignited under the right conditions, and fires burning among them can spread rapidly. Denser fuels with larger stem diameters are less likely to ignite, but they burn longer resulting in more damaging ecological effects. Ladder fuels, shrubby forest plants that enable the spread of fire from the ground to the forest crown, are also a concern.

Reducing Fine Fuels in Grasslands

Invasive annual grasses like cheatgrass and medusahead rye now dominate vast areas in the Great Basin region of Idaho, Utah, and Nevada, areas once dominated by bunchgrasses and shrublands. These annual grasses can form dense carpets of fine stems and leaves that are easily ignited and support quickly

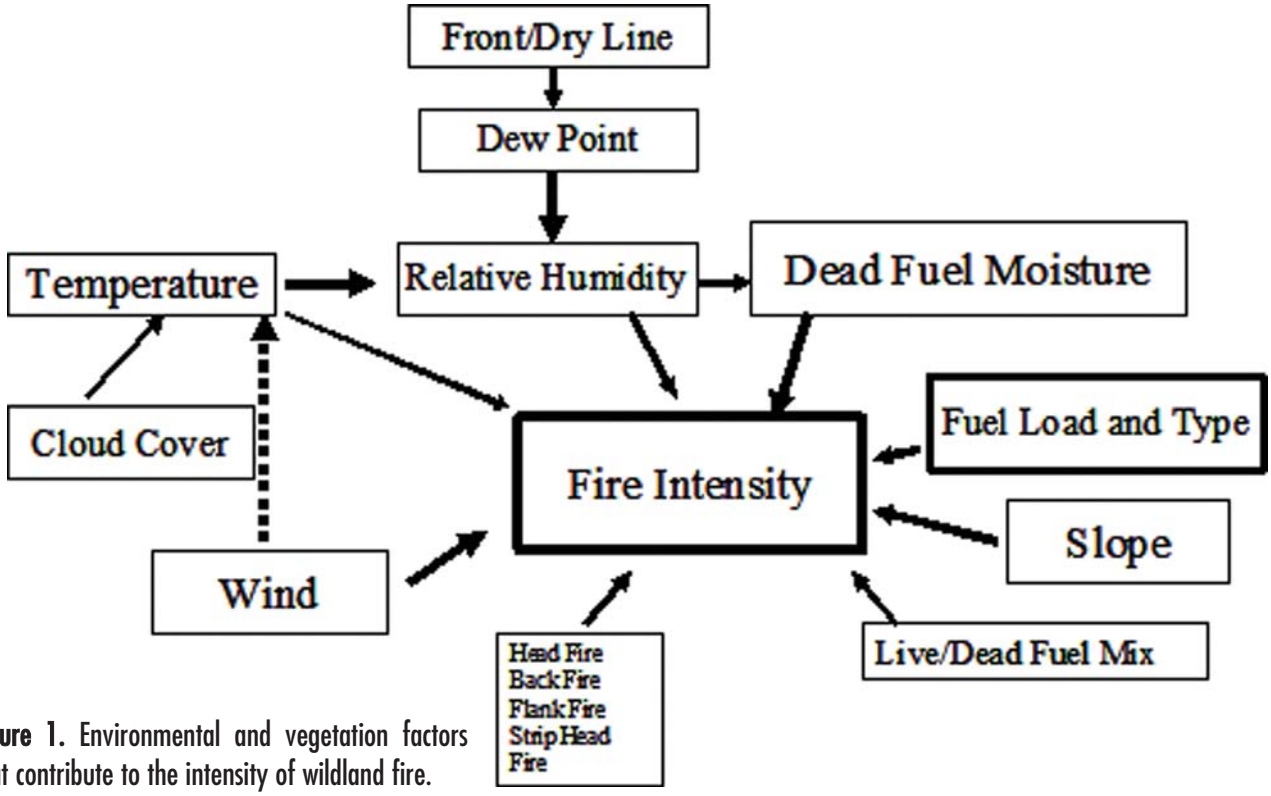

Figure 1. Environmental and vegetation factors that contribute to the intensity of wildland fire.

spreading fires. They also compete with native grasses and shrubs for spring moisture. Simply removing livestock rarely leads to the grasses' demise. However, grazing applied early in the grazing season can substantially reduce the fuel loads from these grasses *(see Chapter 8)*. This concept was applied with sheep grazing around Carson City, Nevada, in a project cleverly coined, "Only Ewes Can Prevent Wildfire." The ewes grazed a fenced corridor at the edge of the city, removing 71 to 83% of easily ignitable vegetation. More than 90% of the nearby homeowners supported the project and preferred the sheep to traditional chemical or mechanical methods of creating firebreaks. This successful project has been expanded to cheatgrass-dominated valleys throughout Nevada.

The East Bay Municipal Utility District has been hiring ranchers for several years to graze cattle on herbaceous vegetation around San Francisco Bay. The district found that livestock grazing is a cost-effective means of biological fuel management to reduce the overall fuel loading of grassland pastures. District plans include grazing before the fire season to reduce grass stubble height and to minimize brush encroachment into grasslands.

Browsing in Shrublands

Goats have been used widely in the foothill chaparral regions of California and Arizona to break up dense shrub stands to reduce the risk of wildfire. In hills around Menlo Park, Oakland, Los Altos, and Berkeley, California, goats have reduced fuel loads in areas too steep for manual labor or mowers. They remove vegetation without disturbing roots or facilitating erosion. These targeted grazing projects are particularly important because they are safe environmentally acceptable, and aesthetically appealing options at the wildland-urban interface.

Juniper is a major ecological and economic problem throughout much of the United States. It reduces livestock carrying capacity and wildlife habitat and increases volatile fire fuel loads. In the Texas Hill Country, goats have been used effectively against juniper encroachment, grazing pastures with young juniper trees and restoring a dominance of perennial grasses. Juniper foliage is laden with volatile plant chemicals called monoterpenes that reduce digestibility and can cause liver damage. Goats have a natural ability to digest and detoxify juniper foliage, so they can be used to prevent solid stands of juniper that could provide fuel for hot, devastating wildfires.

Grazing in Forests

Grazing by sheep and cattle has been applied to forestlands around the world to reduce fire risk.[4] These animals become active participants in agroforestry systems designed to reduce competition among herbaceous understory plants and trees and reduce the likelihood of wildfire. Grazing and browsing can also trim ladder fuels and mimic the fire pruning effect created by the frequent and cool ground fires that historically burned naturally below the forest canopy. Livestock grazing can clearly change the fuel characteristics of forests, although grazing does not always reduce fire risk.[8]

Criteria for Animal Selection

Different species of grazing and browsing animals have different forage preferences. Cattle mainly prefer grass but do consume some forbs and browse. Goats prefer woody browse and grass but will also select forbs. Sheep generally consume mostly grass and forbs and express a lower preference for woody plants. These are general statements: Remember that just because a particular grazing animal prefers and consumes a particular plant in one setting does not necessarily mean that it will react in a similar way when grazing in another plant community. Still, generalities can provide a starting point for developing a prescription for grazing to suppress fire fuels.

Early animal foraging research conducted on the Texas Agricultural Experiment Station near Sonora in the Edwards Plateau Region[2, 3] showed basic foraging patterns. On generally rolling study pastures of about 575 acres, cattle traveled an average of 3.3 miles a day, sheep 3.8 miles, and goats 6.1. Cattle spent most of their time (78%) feeding on grass, 21% on forbs, and only 1% eating woody plants. Sheep and goats grazed grass about half the time, forbs about a quarter, and browse the rest. Most subsequent research suggests that goats consume more browse than either sheep or cattle.

By coupling knowledge of fuel characteristics with the foraging habits of different livestock species, prescriptions can be developed to target specific components of the fuel load. Cattle and sheep grazing has been applied effectively to reduce the risk associated with fine herbaceous fuels like annual and perennial grasses. Goats are better able to manipulate woody vegetation and move among slash in forested situations. Plant compounds that generally create volatile fuels are more readily consumed by goats than by sheep or cattle. It should be noted that targeted grazing is poorly suited for areas with extensive dead woody fuels or slash.

Grazing Strategies to Meet Ecological Objectives

A variety of ecological objectives can be expressed at the landscape level. Examples of these include improving biodiversity, improving water quality and quantity, increasing dominance of native vegetation, reducing erosion, and improving wildlife habitat. Ecological objectives should be included as a part of the overall grazing strategy to reduce fuel loading.

Targeted grazing can be used effectively to reduce fuel loads of grasses and shrublands. Managed livestock grazing is often a favorable option in the wildland-urban interface where homeowners are particularly concerned about fire risk. In these situations, people have heightened concern over herbicide use, are often intolerant of the noise and disturbance caused by mechanical options, and do not find prescribed fire an acceptable alternative so close to their homes.

Fuel Load Reduction

In varying degrees, livestock grazing or browsing reduces fuels. Simply put, livestock consume vegetation and vegetation is fuel, so grazing in large pastures and allotments typically reduces the extent and severity of wildfire. In addition, livestock tend to graze some areas more intensely than others creating patchy vegetation that reduces the continuity of fuel loads and the fires that might burn those fuels.

Firebreaks

Firebreaks, strips of land on which vegetation has been reduced or removed, can slow or even stop the spread of wildfire. They also provide safety zones or escape routes for firefighters. Firebreaks can be created with high-intensity grazing by livestock confined to a strip of land with temporary fencing. For example, grazing has been used effectively to reduce the fuel load and break up continuity of the fuel matrix in annual grasslands.

Brush and tree regrowth are a major problem on firebreaks, necessitating continual maintenance. Woody plants combined with grasses produce a fuel mixture that can spread fire rapidly. The most effective firebreak is one dominated by low-growing sparse vegetation. Perennial bunchgrasses or low-growing grasses make ideal cover for firebreaks. The intermediate grazing capacity of sheep and goats allows them to harvest both grass and brush regrowth, keeping the fuel load cropped closely enough to serve as an effective firebreak.

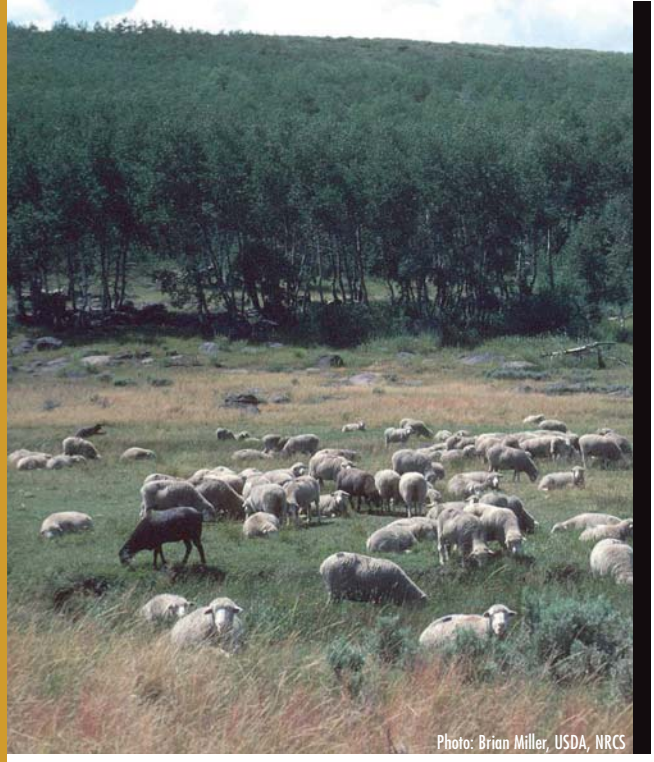

Photo: Brian Miller, USDA, NRCS

Green Stripping

Controlled and repeated grazing of strips can create areas of green plant regrowth that can serve as a break in fuel continuity and slow the spread of wildfires. Green strips can be created by planting late-maturing plants or by grazing strips at the end of the growing season right before the fire season. Grazing in firebreaks can also be applied late in the growing season to keep grasses in a green vegetative stage and delay senescence.

General Grazing Principles

Using livestock to reduce fuel loads, manage firebreaks, and create green strips requires an understanding of the foraging habits of the animals and the response of vegetation. It is important to carefully select the kinds and classes of animals, the seasons of grazing, and the stocking rate to create the desired plant community response. At the same time, unique site and weather conditions beyond the control of management also affect vegetative response to grazing, making it difficult to anticipate the results of grazing activities. Expecting immediate response can be frustrating. Changing animal numbers will change the amount of forage for each animal, which, in turn, will change diet selection, which could then change nutrient intake and animal production. At the same time, changing the grazing pressure will shift the competitive relationships among plant species, eventually changing the plant community or reducing fuel loads.

Animal Production Considerations

Many fire management prescriptions focus on changing fuel loads immediately before the season of greatest wildfire risk. This generally coincides with a period of peak biomass when forage is nutritious and available and conditions for animal production are good. However, heavy stocking levels may be required to accomplish specific fuel-reduction goals, constraining individual animal performance. When managing fine fuel loads, targeted grazing may be applied as the plants begin to dry and become dormant. This is also the time of decreasing forage quality, and grazing at this time may reduce animal productivity.

When grazing to reduce fuel loads of woody vegetation, consider the potential effect of aversive plant compounds. Most woody plants contain chemicals that can reduce plant palatability and digestion. In some cases the chemicals are toxic. Tannins and terpenes are two common classes of detrimental compounds found in woody range plants. Both reduce the digestibility and palatability of forage and, if consumed in large enough quantities, can harm animals. High quantities can also limit the consumption of woody plants and reduce animal performance.

Most woody plants have some chemical defenses, but herbivores coevolved with these plants for thousands of years and have developed methods for dealing with them. They learn to avoid or minimize the use of plants or rely on their digestive capabilities to process and detoxify the harmful compounds. It is important to provide adequate nutrition for animals browsing woody plants high in tannins, terpenes, and other phytochemicals as detoxification imposes an additional demand for nutrients. For example, a protein supplement appears to benefit goats consuming juniper.[6] In trials on the Texas Agricultural Experiment Station at Sonora, the amount of supplement fed was calculated to supply the same amount of protein as alfalfa pellets fed at 1% of body weight. The three supplements (alfalfa pellets, corn, and cottonseed meal) were fed to provide 0.24 grams nitrogen/kilogram body weight. Cottonseed meal and alfalfa supplements increased redberry juniper intake 40% compared with goats fed a corn supplement and 30% compared with goats fed no supplement. Similar results have been observed for sheep grazing sagebrush. Sheep fed a protein and energy supplement spent more time eating sagebrush than those with no supplement.[1]

Effectiveness and Integrated Management

One of the best ways to address a fire fuel problem is to integrate livestock grazing with prescribed fire, chemical, or mechanical treatments. Developing and successfully implementing such a plan requires basic knowledge of forage and animal production, grazing management, and plant ecology. Anyone considering a fuel-suppression program should consider training in these concepts and techniques.

The first step in planning a fuel-reduction action is to inventory the current amount and condition of herbaceous and woody vegetation. This current status (i.e., species composition, amount of fuel, fuel type, etc.) will determine the kind and possible combination of treatments to apply. By understanding plant composition and fuel characteristics, a manager can match the dietary habits of animals with the vegetation. For example, an inventory of an area designated as a firebreak might show fuel loads of mostly warm-season perennial grasses with a few shrub species. This situation would be ideal for grazing cattle or sheep to reduce fuel loads but still retain enough vegetative cover to prevent excessive erosion. In areas dominated by large woody plants, prescribed fire or mechanical techniques may be required, followed by grazing to maintain appropriate vegetation levels.

Prescribed burning can often be included in the overall management plan as an effective tool to increase forage palatability and reduce woody plant cover. The first rule of prescribed burning is to manage for an appropriate fuel load so the burn will be effective and not excessively risky. Grazing management and prescribed fire are inherently interrelated because grass, forbs, and browse can serve as either fuel or forage. However, when grazing pressure is too great, a prescribed fire may be ineffective. An appropriate grazing scheme must be established to create a viable burning program, which requires management to determine specific goals and objectives. It is important for management to focus attention on the selection of objectives.

Grazing management principles form the basis for developing grazing schemes. For example, if the objective is to reduce volatile woody plant fuel and simultaneously increase herbaceous fuel, then the proper choice of grazing/browsing animal must be selected. The grazing/browsing animal is the piece of the system that is directly managed through: 1) selecting the kinds and classes of livestock; 2) selecting the season of grazing; and 3) setting the degree of use (i.e., stocking rate).

A specific scenario that requires an integrated approach is the mixture of volatile fuels, like juniper- and pinion-dominated rangelands, along with enough herbaceous vegetation to provide a continuous fuel load. Pinion and juniper now cover over 75 million acres of the Western United States. This change in vegetation type leads to decreased species diversity, loss of soil and seedbanks, decreased aquifer recharge, increased soil erosion, and increased probability of high-intensity crown fires. Foraging animals usually avoid juniper and pinion pine. Because goats are more tolerant than other domestic livestock of the terpenoid-laden foliage of juniper and pinion, they can play an important role in integrated management plans. Even though goats consume more juniper than other species of livestock, individual consumption is still relatively low at 0.8 pounds a day per head maximum intake of redberry juniper for an 80-pound goat.[6] Also, juniper and pinion foliage above the browsing height of goats continues to be a fire hazard. Mechanical treatment followed by goats might serve as an optimum management strategy. Prescribed fire might also be incorporated. Burning under cool, safe conditions following the mechanical treatment would keep the target species within the browsing height of goats. With this integrated approach, the fuel load from juniper and pinion would be reduced as would the frequency and intensity of goat browsing needed to maintain a desired plant community.

Targeted Grazing to Manage Fire Risk 112

Photo: Gary Wilson, USDA, NRCS

SUMMARY

In summary, manipulating vegetation using grazing and browsing animals is a complex process. Using livestock to manage vegetation is an ongoing and adaptive process that takes time and patience to master. Even the most researched and clearly stated grazing prescriptions will require monitoring and modification. An effective grazing prescription must be based on an understanding of the ecological potential of the land resource and must apply the principles of grazing management, plant physiology and ecology, prescribed fire, and sound business practices. An effective fuel management plan must also include an inventory and monitoring system to measure current conditions and determine if goals and objectives are being met.

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